RAILWAY ENGINEERING
and Maintenance of Way

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The Maintenance of Way Association

THE far reaching importance of the work of the American Railway Engineering and Maintenance of Way Association is well shown by some figures sent out by that body, as follows: The mileage of single track in the United States is 207,977, of which 170,883 miles has representation in the association; 27,980 miles of road distributed over almost every section of the earth's surface are also officered by members of this association. The membership includes not only presidents and engineering officers of railways, but also 174 railroads of which the Baltimore & Ohio has a membership of twenty-four, and in addition to these there are editors or railway journals included among the members. The wide range of official positions held by those connected with the association is an evidence of the democratic principles on which the success of it has been assured. Ability is the sole recommendation for preferment in this organization.

The Electric Third Rail

THE design of the electric conductor of third rail, with reference to the method of contact of the shoe, on important lines equipped for that method of power transmission, seems to indicate a disposition on the part of the engineers responsible for their design, to drift from rather than toward a standard for that form of construction. At first sight the difference in detail may appear too trivial to merit mention, and would be so were not the designs intended for widely different methods of contact. An examination of the designs for the New York Central and of the Pennsylvania road on Long Island shows a diversity of practice, while both have many points to commend them from the standpoint of safety and also protection of the rail from sleet and snow.

The fact that the horizontal distance from the gage line to center of third rail is not identical in the two designs is of no weight in the cases considered, for the reason that the two equipments are not similar in their contact arrangement, the third rail contact being at the bottom in the case of the New York Central design, while that of the Pennsylvania is at the top. These designs appear on their face to be too far apart for interchange of equipment, without considerable complication in the shoe mechanism, and while such interchange may not be desirable or necessary at this time, the question will arise in the future, for the tendency in all things mechanical is for standardization. The situation recalls the old battle of the gages when there were four track gages in use in this country, and the equipment of each road was practically confined to its own rails.

The Hudson River Tunnel Terminal

THE city of New York is in the throes of tunneling, and the preparatory work of excavating for the structures that will be, when completed, the most magnificient railway terminals in the world. Plans are being rapidly prepared for the terminal of the Hudson River Tunnel which will cover two blocks from Cortlandt street to Fulton street northward, and from Church street to Greenwich street westward. This building will extend across Dey street at the first story forming an arcade, and will be the largest structure devoted to office uses in the world; also the tallest skyscraper, the foundations extending sixty feet below the street, and twenty-six stories above ground. The length of the entire terminal will be 429 feet on Church street, 185 feet on Cortlandt street, and 163 feet on Fulton street, and the space enclosed will be 16,500,000 cubic feet.

The tunnel under the Hudson River from Newark has been projected to meet the needs of Wall street and the business district of lower New York, and is being constructed so that the proposed Greenwich street subway will pass over it, the level will therefore be such that the work will go on without interference from either. The work on the bore is well underway from the New Jersey end, and it is being rapidly prosecuted on the New York side, the whole project being planned so that the terminal will be completed when the tubes are ready for service. The terminal structure will be of Granite and White Sandstone and most ornate in finish. The building of the Pennsylvania tunnels under the Hudson and East Rivers has given the stimulus for action looking to the requirements of the vast army of business men who people the lower end of Manhattan Island, and this scheme now

being worked to completion will stand first for taking care of the hordes that transact the business of the city. The new tunnels and subways are recognized as the only solution to the transportation problem, as surface lines have long since ceased to be an adequate means to handle the rapidly growing business population.

Collapse of a London Railway Station

ONE of those unexpected events that occasionally startle a community and puzzle engineering experts, occurred on December 5th, when the roof of the Charing Cross Station in London fell in, killing and injuring several persons. A great many theories have been proposed for the failure of the structure, but all is simply conjecture. The train shed was built in 1860, and was considered to be a well designed piece of work, having a roof with arches of 130 feet 6 inches span, 35 feet from center to center and with a rise of 45 feet. The construction of the trussing is said to be in accordance with what would be called good practice today, in taking care of the stresses with a view to equalization, or in other words leaving no weak link, consisting of a main truss of a plate ½x18 inches having angles at the edges 3x6x½ inch. The struts and diagonal braces consisted of 6x3x½ inch angles, and tie rods at bottom about 4⅝ inches in diameter, all these details being of wrought iron.

The dispositon of these roof members have the distinction of having been arranged from designs made by Sir John Hawkshaw, which would seem to be sufficient to inspire confidence in the accuracy of the calculations involved in its strength.. The collapse is attributed in general, to a low initial factor of safety—that convenient refuge for all engineering failures, and the work has also been criticised on the ground that engineers were not sufficiently familiar with metal construction at that time, to design a structure of stability, even for quiescent loads. The truth or falsity of the former claim is demonstrated by a reference to the drawings, if they are still in existence, but the fallacy of the latter proposition was in evidence in the Victoria Tubular Bridge over the St. Lawrence River at Montreal, which was built by Brunel, an engineer noted for the permanent character of his work, so permanent in the case mentioned, that no question ever arose as to its stability under years of heavy railway traffic.

Neither of these engineers knew anything about the latter day theories or known facts concerning the effects of live loads on iron or steel, but there is no doubt that they were fully alive to the fact that the breaking stress of materials under a live load was less than that for a statical load, since the experiments of Wohler to determine the relation between the elastic limit and endurance of iron under repeated stresses were conducted in 1871. This would, however, not have been of especial interest to Hawkshaw in his roof design, but would have been of the greatest moment to Brunel with his bridge, had he lived at that time. His work showed that the factor of safety was a live element in his calculations, while the Charing Cross roof has given token of too little attention to the safety factor.

Water Softening for Boilers

INTEREST in the subject of water purification for steam purposes is unflagging, and the question of how to best reduce the solids of "bad water" to a harmless condition was never more important, nor has it ever forced railway officials to a keener realization of the necessity of water softening plants than at the present time—and the anxiety to extract the fangs of the monster that subsists on what should properly go to swell dividends, will keep that interest perennial. A paper recently presented to the Western Society of Engineers by T. W. Snow, M. W. S. E., contains many points that are especially valuable, and some excerpts therefrom are given herewith:

"The great majority of railways in the United States are using the same improvident methods of furnishing water as followed by our grandfathers. One of the great trunk lines entering Chicago uses annually 9,288,000,000 gallons, at an average cost of only 3 cents per 1,000 gallons. In order that this high economy may be appreciated it will be stated that until within the year, the average cost per 1,000 gallons on a line equally as large, was 23 cents. This line has secured the services of one of the best water experts in the United States, and he is rapidly rebuilding and reorganizing all water stations, and in another year will be able to make quite as good a showing as in the first instance named.

"Just as long as railway companies have as many water superintendents as the road has divisions, good service cannot be expected. When the railways appreciate the importance of an abundant water supply, they will then create such a department with a proper man at the head. Such a man will have a larger field for reform than in any other department. Having started right, the question of character of the water supply should receive attention. A simple analysis of the water to be had will determine its fitness or unfitness for use in the raw state for boiler purposes."

The author referred to the installation of three purifying plants on the Missouri Pacific, in a bad water district during 1905, on which division there were 21 engine failures in one month. After six months use a direct saving of $200 per month in boiler makers' wages and cost of tubes was reported by the Master Mechanic. This saving was due entirely to labor and material, and did not take into account the indirect saving due to better and quicker service, nor the assignment of the reserve helper engines to useful regular work, neither did the saving represent the economy in fuel, due to better steaming.

The scale taken from the engines before the softening plant worked these economics, was over ¼ inch thick. It does not require a vivid imagination to picture the size of coal pile that is necessary to force a thermal unit through such insulating material on the flues and firebox of a boiler. Treatment of the water sent these scale producing elements down short of their power to do harm. Rawkine formulated, with clean iron as unity, the resistance of carbonate of lime to the passage of heat as 17, and of sulphate of lime as 48, and while these values are only comparative and meaningless to the layman, they speak

eloquently to a railroad company, for scale deposit on the heating surface of a boiler means not only additional maintenance expense, but complete demoralization of the train service.

New Freight Terminal at Cincinnati, of the C. N. O. & T. P. Ry.

THE Cincinnati Southern Railway, which is owned by the city of Cincinnati, Ohio, is operated under a long term lease by the Cincinnati, New Orleans & Texas Pacific Company. By referring to the accompanying map, it is seen that the road enters the southwestern part of the city over its own bridge across the Ohio river and runs directly north along McLean Ave. to its largest Cincinnati freight yards. On the eastern side of these yards is the Lincoln Park freight depot, a district freight house about 400 feet long. This is in an industrial region like the Brighton terminal in the northwestern part of the city, which is reached by a line running north from the McLean Ave. yards.

The present principal freight terminal of the C. N. O. & T. P. is at Front and Mill streets, near the river. It is rented from the B. & O. S. W. and is reached by a track of the latter, taking approximately the same route as the indicated proposed viaduct. The depot was built in 1857 by the Ohio and Mississippi railroad, making it old and inadequate for their present business. It is also inconveniently situated relative to the business district of the city. In order to obtain a suitable site having the desired location in the wholesale district, improved propearty at an expense of more than $1,300,000 had to be acquired. The new terminal fronts on Vine street and extends westerly through three city blocks to Plum street. When completed the buildings will occupy the space between Commerce and Front streets. The team tracks will be across the latter street on a space nearly as large as the depot site.

Great difficulty was encountered in building the foundations, due to the presence of wells, old privy vaults, deep cellars, etc., which were found when the old buildings on the ground were wrecked. The buildings con-

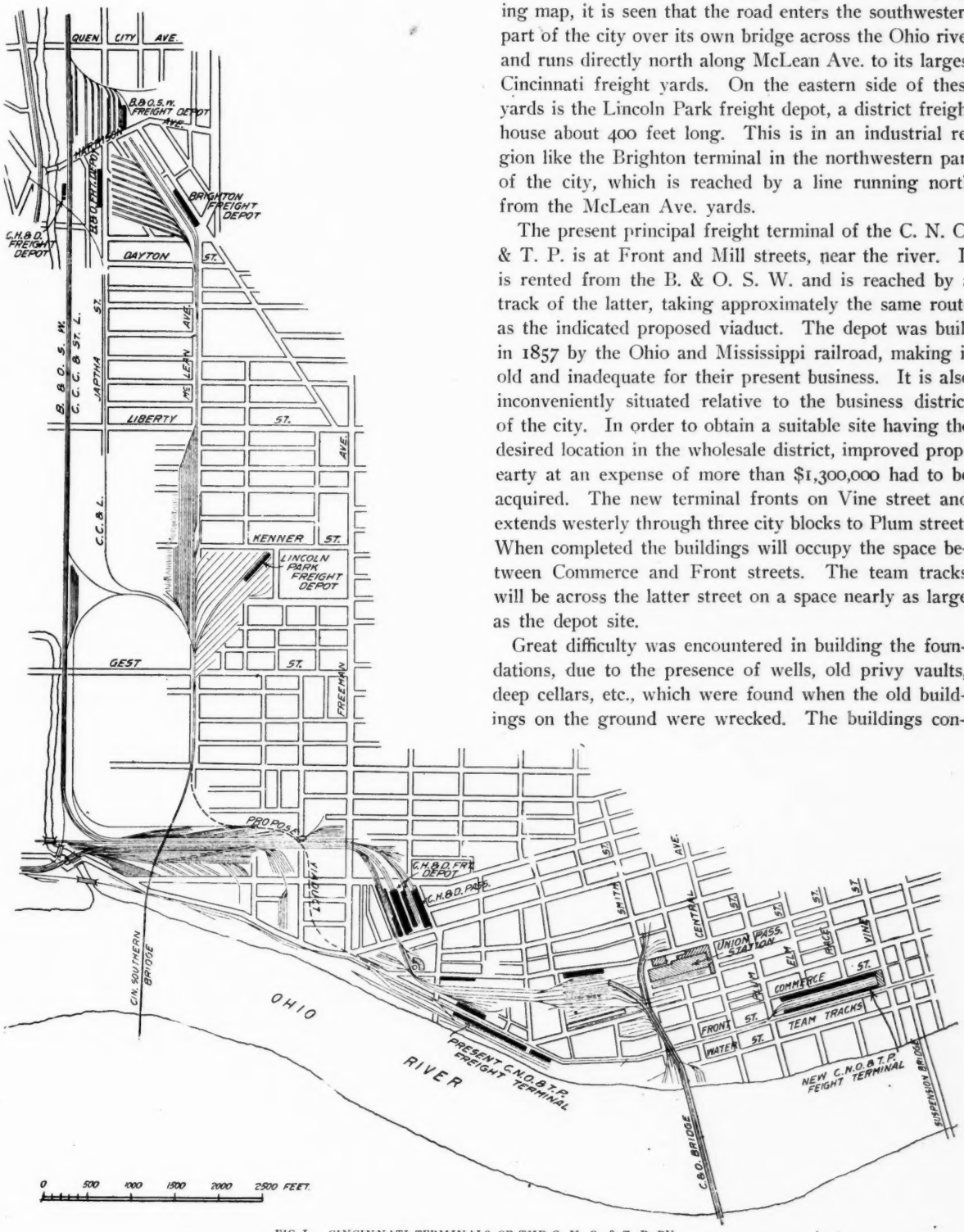


FIG I. CINCINNATI TERMINALS OF THE C. N. O. & T. P. RY.

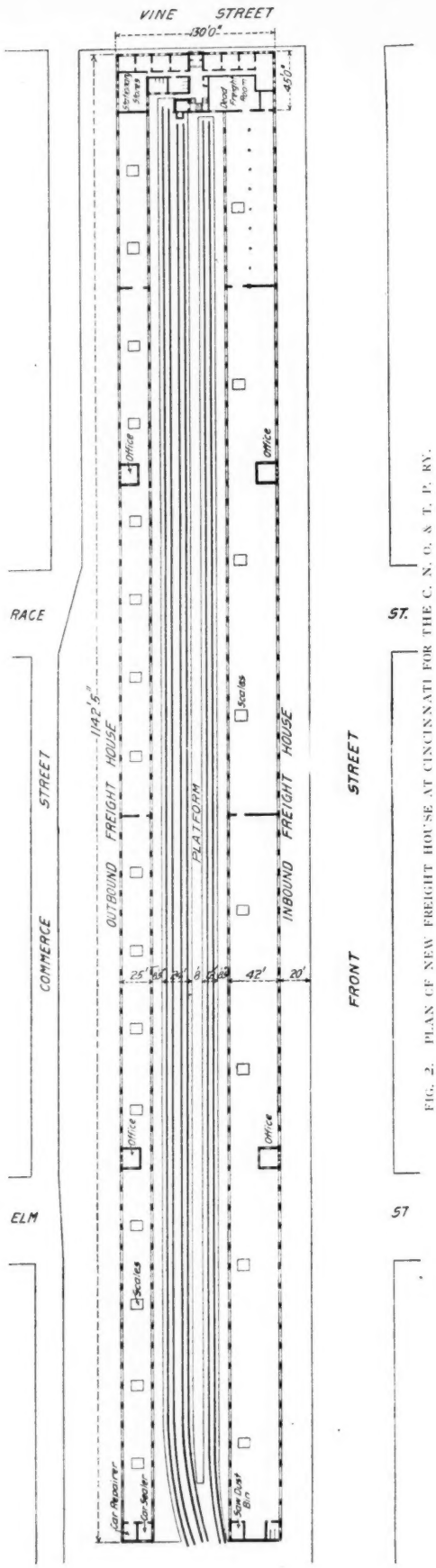


FIG. 2. PLAN OF NEW FREIGHT HOUSE AT CINCINNATI FOR THE C. N. O. & T. P. RY.

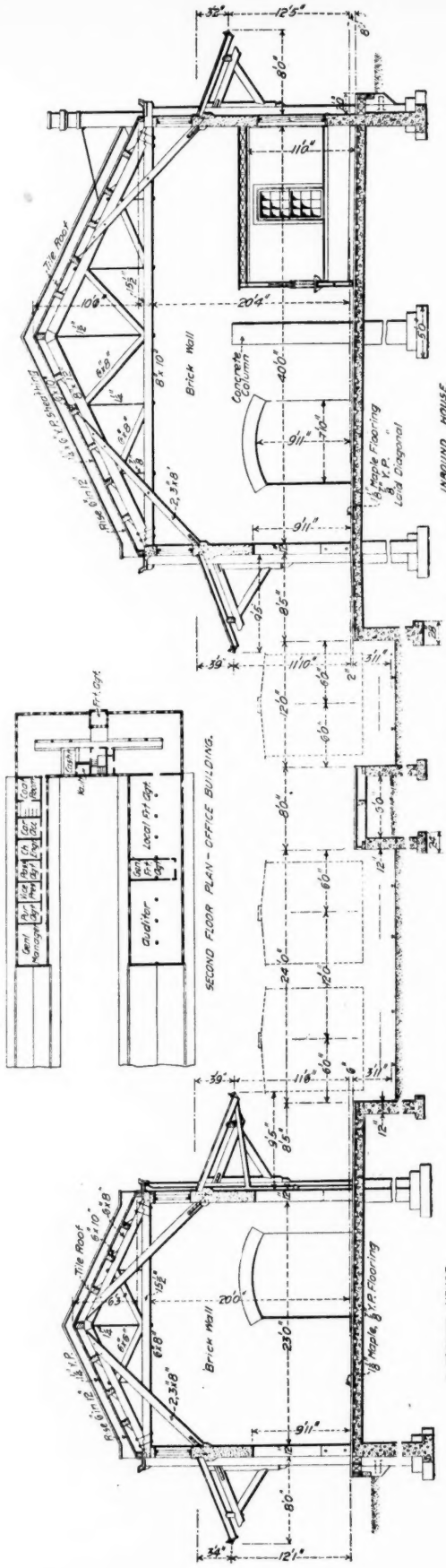


FIG. 3. SECTION OF NEW FREIGHT HOUSE AT CINCINNATI FOR THE C.N. O. & T. P. RY.

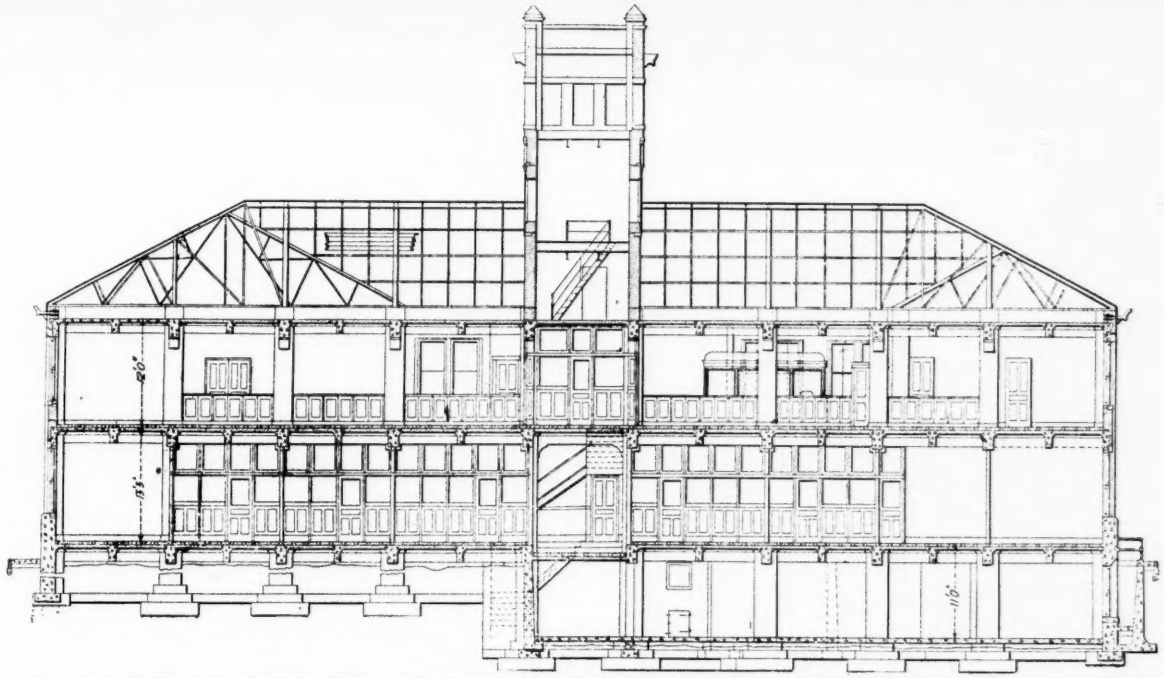


FIG. 4. LONGITUDINAL SECTION THROUGH OFFICE BUILDING, NEW FREIGHT HOUSE AT CINCINNATI FOR THE C. N. O. & T. P. RY.

sist of a two-story and basement office part with 130 ft. front on Vine street and 50 feet deep. The inbound and outbound freight houses extend westerly from the office. The inbound building faces Front street and the outbound, Commerce street, the whole forming a U shaped structure. The freight houses are each 1,100 feet long, the outbound being 25 feet and the inbound 42 feet wide. Both have an 8½ ft. platform on the track side. Between the two buildings are three tracks, two serving the outbound and one the inbound freight. Between the inbound and outbound tracks is a platform 8 feet wide and extending practically the entire length of the freight houses. Each freight building has a second story 135 feet long adjoining the office building, which are to be used as record rooms for the general offices of the railroad company.

The office building is to be of reinforced concrete construction, with steel roof trusses and tile roof. It will be faced with pressed brick and have stone trimmings. The freight house will also be of reinforced concrete, but with wooden roof trusses. They will be without the brick veneering, and the walls and piers separating the doors will show a tooled or floated surface.

It was originally intended to put the buildings on piling, but this was abandoned on account of the space having been occupied by heavy warehouses for a long time without any serious difficulty. Broad footings of reinforced concrete were put in instead of the piles for rests for the columns and pedestals, the dimensions being such that a load of 3,000 lbs. per square foot could be carried on the sandy clay soil.

The details for the reinforced concrete construction to be used are not yet fully decided upon. The loads for which designs are being prepared are: 125 lbs. per square ft. for the first and second floors of the office building; 300 lbs. for the stationary store room and the record rooms over the freight houses; 100 lbs. for all attic floors. It is not anticipated that any unusual design or construction will be used in any part of the buildings. A 1-2-4 mixture of concrete will be used throughout. All footings, beams and floors will be reinforced with Kahn bars, and columns with plain rods ¾ inches to 1 inch in diameter. There are expansion joints where the freight houses join the office building and every 90 feet along the freight house walls. The 4x4 inch floor timbers of the office building will be a plain concrete chimney 56 feet high and 2 feet 6 inches square inside. The walls are 21 inches thick up to the roof of the building, reducing above that to 17 inches and then to 13 inches. The tower will be 65½ feet high above the street, it is of brick and steel with stone trimmings.

A cross section of the freight houses and the platform is shown. From this it is seen that the platforms on the track sides of the two houses are covered by roofs bracketed to the building walls. The street sides of the buildings also have a projecting roof 8 feet wide. The roof truss knee braces, which are formed of two 5x8 inch timbers, rest on corbels on the walls of the house. They are each anchored to the wall by a ½x3-inch strap bolted to the brace. This strap is given a quarter turn and anchored into the concrete by a short vertical rod passing through a hole in its end.

The space under the houses between walls, including the platforms, is filled with earth rammed in layers. On this will be laid a double floor of yellow pine and maple respectively, resting on sills bedded in a 6-inch layer of concrete. The floor of the outbound house has a slope of 6 inches to the edge of the platform at the track side, while the inbound house floor slopes 8 inches toward the street side. Both sides of both buildings will have

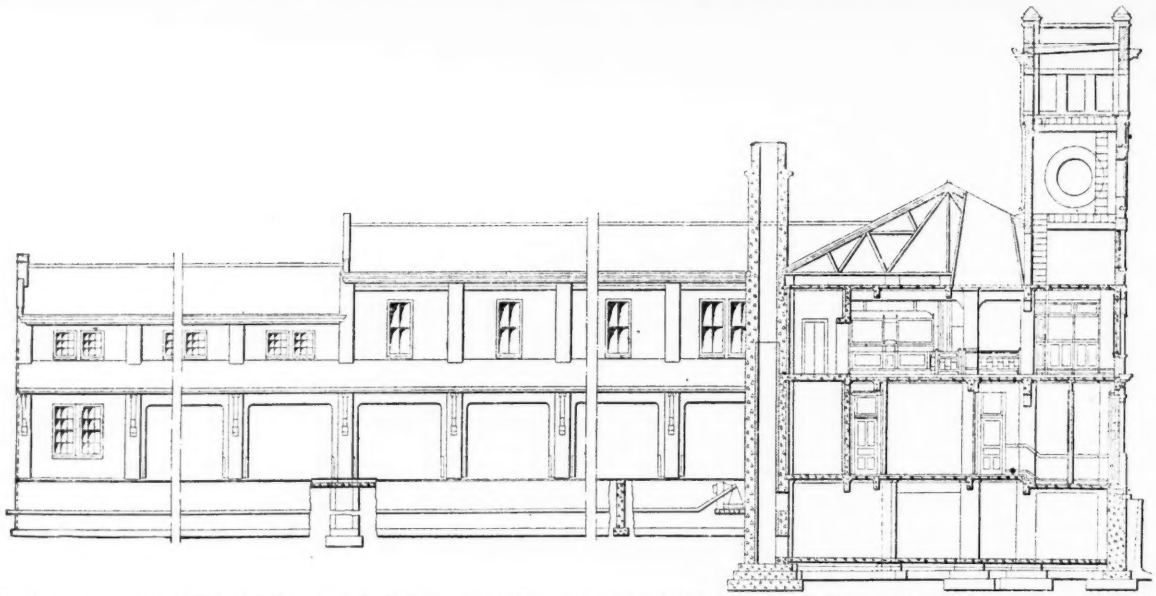


FIG. 5. CROSS SECTION THROUGH OFFICE AND SOUTH SIDE ELEVATION OF THE RECEIVING HOUSE, NEW FREIGHT HOUSE AT CINCINNATI FOR THE C. N. O. & T. P. RY.

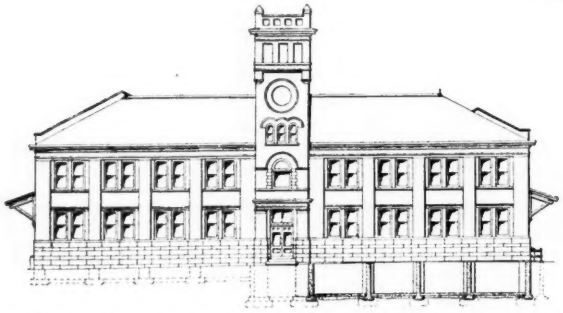


FIG. 6. VINE STREET ELEVATION, NEW FREIGHT HOUSE AT CINCINNATI FOR THE C. N. O. & T. P. RY.

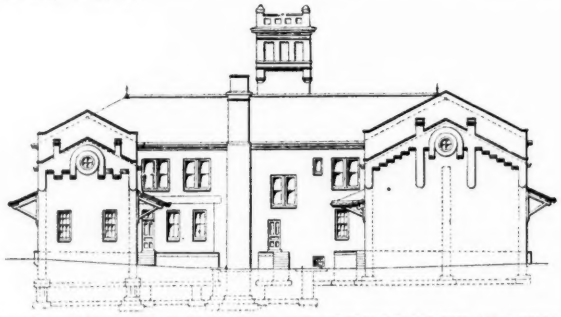


FIG. 7. PLUM STREET ELEVATION, NEW FREIGHT HOUSE AT CINCINNATI FOR THE C. N. O. & T. P. RY.

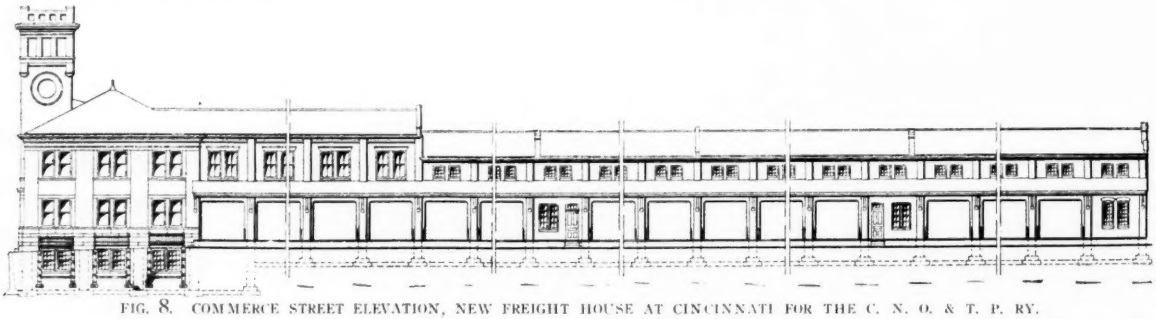


FIG. 8. COMMERCE STREET ELEVATION, NEW FREIGHT HOUSE AT CINCINNATI FOR THE C. N. O. & T. P. RY.

rolling steel doors 11½ feet wide by 10 feet high, with piers 3½ feet wide between all doors.

Each track between houses has room for 27 cars or 81 cars for the three tracks. The capacity of the outbound house will be double that of the present terminal, while the inbound will have six times as much room. All the switching to and from the present house is done by the C. N. O. & T. P. by the B. & O. S. W. For the new terminal the approach will be temporarily over the B. & O. S. W. and the P. R. R., which will do the switching jointly. Proceedings have been begun to acquire land for a viaduct approach about 3,000 feet long from the north end of the Ohio river bridge. Its route will be approximately as indicated on the map, coming to the surface at its junction with Front street. From this point the company expects to put in its own surface track to the terminal.

At the present time the foundations of the buildings have been completed and work has begun on the superstructures. It is expected to have the terminal ready for occupancy by the spring of this year. Mr. G. B. Nicholson, Chief Engineer of the C. N. O. & T. P. is Chief Engineer and Superintendent of the terminal work for the trustees of the Cincinnati Southern. He is being assisted by H. E. Warrington, Principal Assistant Engineer, and Adam Ritter, Assistant Engineer of the C. N. O. & T. P. The Collier Bridge Company, of Indianapolis, Ind., have the contract for the construction complete. The buildings will cost about $250,000. We are indebted to Mr. Nicholson for the description and illustrations.

The Single-Phase Electric Locomotives and Power Equipment of the St. Clair Tunnel Company

THE single-phase electric locomotive adopted by the St Clair Tunnel Company for the operation of the St. Clair tunnel, which connects the American and Canadian divisions of the Grand Trunk Railway System, will weigh approximately 62 tons and will develop a draw-bar pull of 25,000 pounds on a 2 per cent grade at a speed of 10 miles per hour. It is of the rigid frame type with driving axle boxes held in the same frame that contains the draft gear. It will be mounted on three pairs of driving wheels which will sustain the entire weight, distributed by equalizer bars similiar to those used in steam locomotive practice, will have an outside frame supported on semi-elliptical springs, and will be equipped with Westinghouse friction draft gear, MCB automatic couplings, air sanding apparatus, and bumper steps, front and back. The cab will be of sheet steel mounted on a framework of iron which supports both walls and roof.

A motor will be geared to each axle, giving each unit an aggregate rated capacity of 750 h. p. They are of the Westinghouse single-phase alternating-current, series-wound, compensating type, whose successful development was first publicly announced in the notable paper read by Mr. B. G. Lamme before the American Institute of Electrical Engineers in New York, Sept. 26, 1902. They are of the same general character as the motors selected by the New York, New Haven & Hartford Railroad Company for the operation of their line between New Haven and New York. Each motor will weigh complete approximately 14,500 pounds, the armature weighing approximately 5,600 pounds.

Collecting Devices and Overhead Construction.

Each locomotive unit will be equipped with a pneumatically operated pantagraph trolley to collect current from the overhead lines outside the tunnel and throughout the yards. The proportions of the pantagraph will be such that, when extended, it will make contact with the trolley wire 22 feet above the rail, and when closed down, the contact shoe will not extend more than 18 inches above the roof of the locomotive. The pantagraph will have a broad base and will be constructed of light and stiff material.

A 0000 grooved overhead trolley wire will be suspended from single 5/8 inch, high strength, double galvanized, steel strand, messenger cable by hangers of varying length in such a manner that the trolley wire will be approximately horizontal. The messenger cable will be swung from structural iron bridges located throughout the yards and are of suitable length to span the proper number of tracks. There will also be a small section of track equipped with a trolley line swung by catenary suspension from bracket arms which are supported on lattice-work poles.

Current Supply.

For the operation of the electric locomotives a complete power plant will be installed by the St. Clair Tunnel Company, including two 1,250 kw., 3,300 volts, 3-phase, 25 cycle, 1,500 r. p. m., rotating field, Westinghouse steam turbine units with the necessary complement of switchboards, exciters, lightning protective apparatus, etc. This station will also supply current to light the buildings, yards and tunnel and approaches and operate the sewage system, to run motors in the round houses and for other purposes.

Operation.

The new equipment will handle that portion of the Grand Trunk Railway System which connects the divisions terminating at Port Huron, Mich., and Sarnia, Ont., on opposite sides of the St. Clair river. The tunnel proper is 6,032 feet long and the line to be electrically operated measures 19,348 feet from terminal to terminal.

A pair of the new units will be capable of hauling a thousand-ton train through the tunnel without division. Mechanical considerations limit the advisable weight of train in the tunnel to these figures. Heavier trains can be divided or sent through together with locomotives in front and behind. The service requires that each unit shall take a train of 500 tons through the tunnel block from summit to summit in 15 minutes, under the following conditions:

It will be coupled to the train on a level track at a point 1,200 feet from the summit and must accelerate it up to a speed of 12 miles per hour in two minutes, at the end of which time it will have reached the summit of the grade leading down into the tunnel. It will then run down a grade of 2 per cent to the level track in the tunnel at a speed not exceeding 25 miles per hour, continue on the practically level stretch under the river, and then draw the train up a 2 per cent grade at the rate of 10 miles per hour to the level track beyond the tunnel approach on the other side. It must then gradually accelerate the train until a speed of 18 miles per hour is reached. Each unit must be capable of exerting a tractive effort of 25,000 pounds for a period of 5 minutes in addition to the energy required to accelerate the train at the starting point and to run with it into the terminal yard, from which point it must immediately run back to a position 1,200 feet from the summit, couple to another train and be ready to start through the tunnel in the opposite direction. It must therefore make a run of the character described every 30 minutes.

Six of these locomotives are to be furnished by the Westinghouse Company. It is expected that the electric equipment will greatly relieve the traffic congestion now existing and due in a large measure to the necessity of dividng trains at the terminal points, and to greatly simplify the operation of the road. Its opening will mark the progress of electrical methods in the railway field under conditions which seem peculiarly fitted to demonstrate its practical advantages in heavy service. That the single-phase system has been adopted for so important an undertaking makes evident the recognition accorded the alternating current by railway engineers, and indicates that its claims have been verified by the service already rendered.

The work of installation will be conducted under the

supervision of Mr. Bion J. Arnold, of Chicago, Consulting Engineer for the tunnel company, by whom the plans and specifications were prepared. Mr. Arnold was one of the first engineers in America to advocate the employment of the single-phase, alternating-current system in railway service. He is also a past President of the American Institute of Electrical Engineers, a member of the Commission in Charge of the electrification of the New York Central Railroad system in New York and has been closely identified with many electrical developments of great importance.

First Electric Operation on the West Shore Railroad

THE first section of the West Shore Railroad 3.17 miles long, between Frankfort and Herkimer, has been opened for electric service and electric cars of the Utica and Mohawk Valley Railway are using this section of track in joint operation with steam trains. This opening marks an advance in steam roads applying electricity to their main lines for handling local passenger traffic. The present use of this section was brought about by the Utica and Mohawk Valley Railway company on account of their having difficulty in getting the proper right of way privileges through the municipalities Ilion and Mohawk. It is the first piece of track to be equipped electrically on the West Shore, which is to be operated by electricity from Utica to Syracuse.

At each end of the electrified section of the steam road, which will be used jointly by steam trains and electric cars, the company has installed block signals of the standard New York Central type, and a third block has been established in the middle of the section, so that three miles of track will be operated as two distinct blocks and the movement of all cars and trains will be made by signals.

The electric operation for the present will be by direct current motors on the cars, but the overhead construction is designed eventually for single phase operation. For this purpose the catenary construction of trolley wires was used. Advantage has been taken in electrifying this section to make experiments, and the lessons learned from it will be applied in the work of electrification of the remaining distance from Utica west to Syracuse, work of which is already under way.

A 0000 grooved copper trolley wire is suspended from the catenary, which consists of a 9-32 inch extra high strength steel cable covered with weatherproof insulation to protect it from deterioration caused by locomotive gases. The hangers or spreaders between the trolley wire and the catenary are placed 10 feet apart and consist in each case of a ½ inch iron pipe flattened at the top to bolt between the lips of a strap clip attached to the catenary and threaded at the bottom into the boss of a bronze clip attached to the trolley wire. The bronze clip on the trolley wire is held together by four screws and the entire clip is 5 inches long.

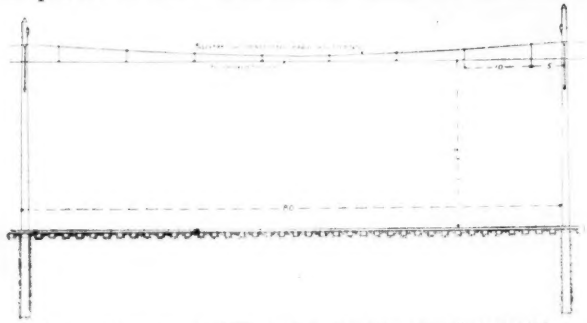


FIG. 1. CATENARY CONSTRUCTION ON WEST SHORE RAILROAD.

The poles are Southern white ceder and the side brackets which carry the catenary are made of extra heavy 2 inch iron pipe. These pipes are reinforced by a bracket from the bottom and a wire from the top. The line is put up with large insulating collars slipped over a bracket arm to receive the catenary. This design was followed so as to use the higher voltage for the single phase current at some future date. The whole overhead construction, including the clips, spreaders, catenary and arms with the exception of the trolley wire, have been painted with Graphite paint for protection against the locomotive gases. By experiment it has been found the gases have no deteriorating effect upon the trolley wire but have the tendency to attack unprotected iron or steel.

The type of overhead catenary construction used is shown in the accompanying drawing. From this it is seen that the poles are spaced 80 feet apart and the wires are drawn a little tighter than the true catenary would be. The spreaders are spaced 10 feet apart with the first one 5 feet from the pole. The spacing of poles and spreaders is somewhat closer than the ordinary construction owing to the fact that the track will be used jointly for steam and electric operation; for this reason it was deemed advisable to take more than usual precautions to avoid any possibility of interruption in either service. The trolley wire is carried 24 feet above the top of the rail which necessitates the the use of a 14 foot trolley pole on the cars. By using a special design of trolley base no difficulty has been encountered in this regard. The base is carried directly over the center of the rear truck, which gives a most advantageous location.

At one point of the line where it passed over a crossing, it was necessary to make a span of 220 feet between poles. From this spacing it is seen that in

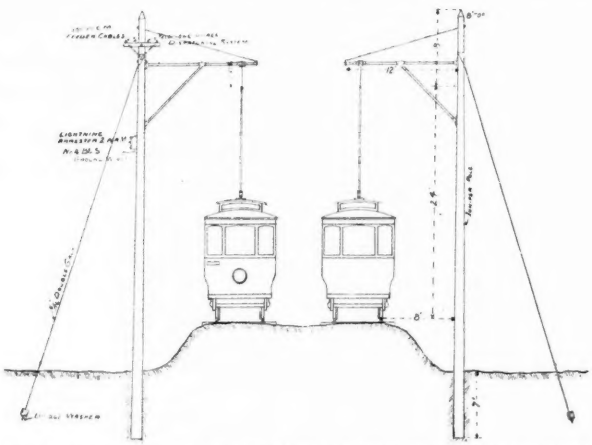


FIG. 2. CROSS-SECTION OF CATENARY CONSTRUCTION ON WEST SHORE RAILROAD

MAP
OF THE
UTICA AND MOHAWK VALLEY RAILWAY
1904.

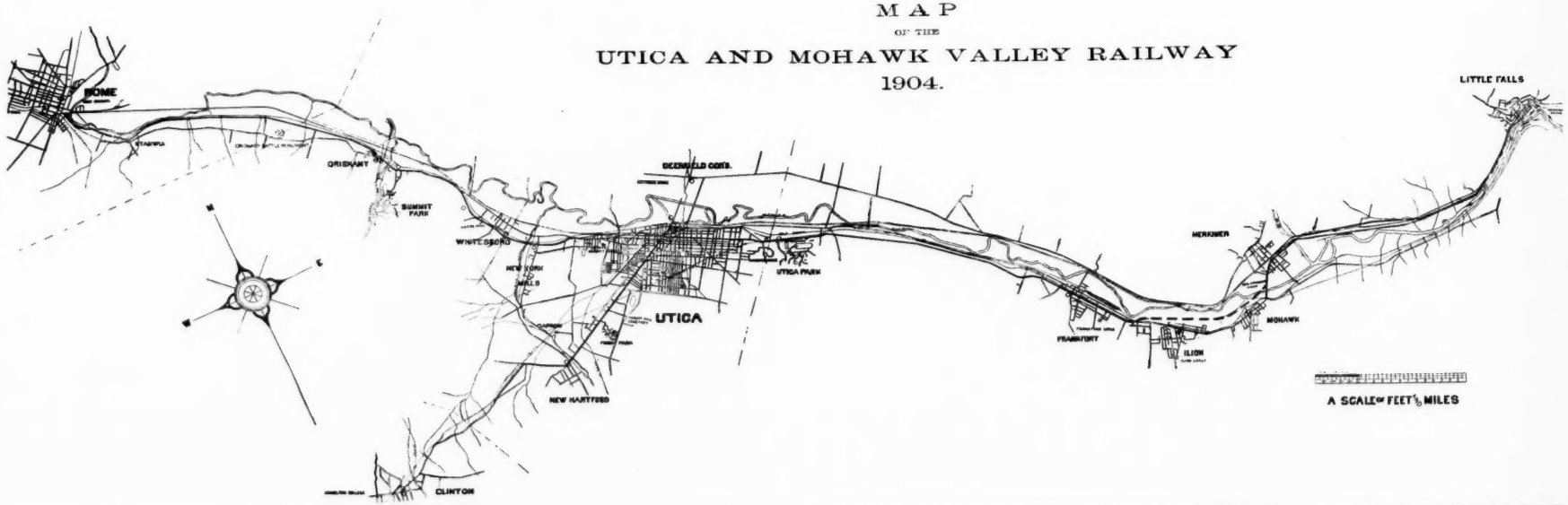


FIG. 3. CONNECTING TRACKS BETWEEN STEAM AND ELECTRIC SECTION OF THE WEST SHORE RAILROAD

FIG 4. ELECTRIFIED SECTION, WEST SHORE RAILROAD TO BE USED JOINTLY BY STEAM AND ELECTRIC TRAINS

straight away electric railway work catenary spacing could be carried up to 300 feet with safety.

One rail on each track on the division has been reserved for signal operation while the other is bonded with Lord Electric soldered bonds placed on the side of the rail head to carry a return current.

Steam Shovels

THE steam shovel is now used so largely in railroad construction work that many of the engineers employed by the various companies are making a special study of the latest forms of construction for the purpose of determining just which one will best suit their requirements. Hence, no article on this subject is of interest to them unless it embodies details of construction, and in taking for illustrative purposes the type of machine offered by the Allis-Chalmers Company, of Milwaukee, we have secured from one of their engineers a verbatim statement concerning the design of this shovel, which we reproduce herewith.

"The shovel is placed on a substantially constructed car. Every strain to which the heaviest digging subjects the car is carefully considered and provided for. Trucks are of the all steel, "Diamond" pattern and draft gear with automatic couplers is provided, all approved by the Master Car-Builders Association.

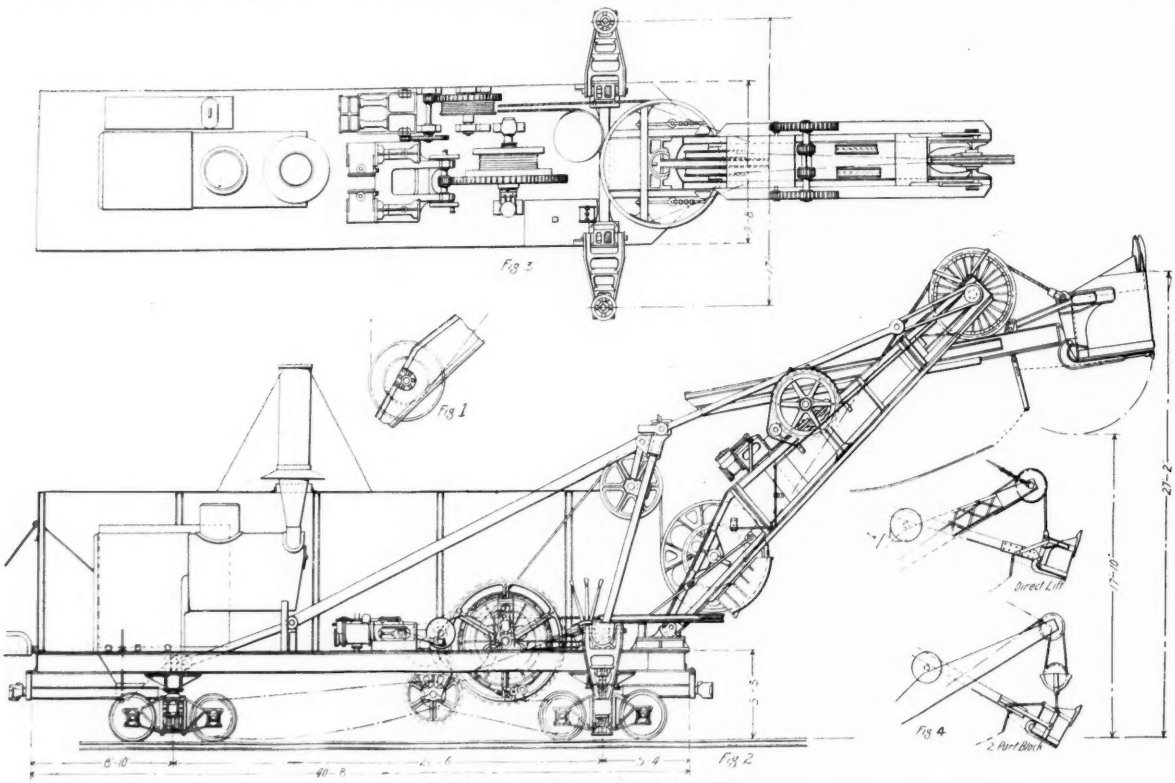
"The A-frame uprights, together with the jack-arms, form a support for the boom that virtually rests on the ground and relieves the car of all strains. The tension rods connect the jack-arms in such a manner that there is no side thrust on the jacks. The A-frame is a single forging capped at the upper end with an appropriate cast steel head, where all the strains intersect at a point.

"There is no part of a steam shovel subjected to so severe alternating strains as the A-frame, which fact has been fully recognized by steam shovel builders, and the old method of making it a riveted section in the uprights has been largely abandoned, the solid bar being substituted. Both uprights are one continuous piece, which has produced an A-frame that is unbreakable.

"The boom is made of angles and plates with cast steel inner and outer ends. It is heavily plated, and ribbed for side strains on lower flange. The shape of the boom is shown in Fig. 1, and attention is called to the fact that the drum shaft is built into the boom. This is done without weakening the boom in any way; in fact, the method tends to strengthen that member materially.

"It is self-evident that weight on the boom, or turntable, is detrimental, so it is good practice to only burden this member with what is absolutely necessary. In line with such a simple deduction the ropes are led so that the strains produce a lifting effect at the foot of the boom, and the engines are put on the car, which secures more the shovel, secures a high lift and long reach, and does away with a great quantity of gearing by simple and strong devices, without a material departure from the usual method. In following this course a light load is secured on the turn-table and it can swing more rapidly than any shovel on the market reducing strains and friction.

"Figures 2 and 3 show the method of operating. The hoisting drum is geared to a hoisting engine, doing away



ALLIS-CHALMERS STEAM SHOVEL

with all jack-shafts and their attendant friction. From the hoisting drum the rope runs over a large sheave suspended from the A-frame to a differential drum located on the boom. This differential drum is made up of a drum of large diameter, with a drum of smaller diameter rigidly attached to each side, the smaller drums having the same diameter. This makes a drum with one diameter of, say, 7 ft., and two drums of, say, 3½ ft. each. The rope passes a sufficient number of times around the larger diameter of the differential drum, the end being permanently attached. From the small diameters of the differential drum two ropes lead to the dipper over the head sheaves. These ropes are fastened to the drum. Winding the rope on the hoisting drum will cause the hoisting rope to run off the larger diameter of the differential drum and the two ropes attached to the dipper to wind onto the smaller drums. This makes a step-up in the pull exerted, without the use of jack-shaft gearing. The rope running from the large sheave suspended from the A-frame to the large diameter of the differential drum is centrally located over the axis of the swinging, or turntable, so that the twist of the rope takes care of the turning without any trouble, doing away with the necessity for guide pulleys. A glance at the illustrations will show that, when the digging strains are exerted, the tendency of the rope between the sheave at the head "A" frame and the drum on the boom exerts an upward pull on the differential drum and lower end of the boom, thus relieving the turn-table of weight. Taking into consideration statements made by other shovel makers as to the weight of the material they place on their turn-tables, it can be stated positively that the weight removed from this member by this form of construction and method of operating is about 15 tons, when the shovel is digging, and 7 tons when shovel is empty, which is no small matter to be swinging around from two to four times a minute. These figures are based on a three yard shovel.

"The size of rope required to stand the digging strain exerted at the shovel when a direct lift is employed is so great as to neccessitate large diameter sheaves to make its use possible. Take, as an instance, 2-inch plow steel rope, which shall never be used on a sheave of less diameter than 8 feet. To give a reasonable length to the rope, this would be able to work with 74,000 lbs. strain. By using 2 ropes of 1⅜ inches diameter the same strength would exist, and sheaves 5 feet in diameter be perfectly proper. The construction makes the use of two ropes, from the differential drum on the boom to the dipper, the best possible method, and, as the differential drum decreases the strain in the rope that runs onto the larger diameter about twofold, it is possible to use a single rope on the hoisting drum of the same diameter as either of the ropes that run from the small diameter of the drums to the dipper, with good results.

"Attempts are being made at the present time to operate large shovels with large rope by a direct pull, instead of reeving the rope through small sheaves at the head of the boom, but as this rope must lead to the hoisting drum over small sheaves—sometimes numbering as high as five —all the evils of sharp bends over small sheaves are encountered. In addition to this the rope must run onto a small drum, and large rope subjected to such treatment cannot last any length of time. A glance at catalogues issued by wire rope makers will show the stress laid on the necessity for having the sheaves and drums of a sufficient diameter to suit the diameter of the rope used.

"Following this line of thought, it is easily seen why the earlier forms of shovels were equipped with chains for digging, as chains would take the short turns, and, as necessity forced the use of such crude appliances, the enormous friction engendered was entirely ignored. The chains will do the work and will add 20 per cent to the coal consumption. They will break without warning, and take considerable time to replace, and this time must be taken whether it suits the convenience of the user or not; whereas, the rope gives evidence of its conditions and can be replaced at the most convenient time. It is also an advantage to have short ropes to replace in case they get too badly worn.

"The dipper is directly connected to hoisting ropes without the use of a bail, which gives large clear opening for the admission of the material. This makes it possible to lift a full load without its being "struck," by the bail and losing part of its contents, and admits of a higher lift. That method of fastening also reduces the necessary length of the boom to accomplish the most desirable results.

"The engines built for this work are of a larger size than those furnished by other makers for the same sized shovel. This enables them to be run slower, thus reducing vibrations and wear and tear generally. With the exception of the thrusting engine, they are placed on the body of the car, where any vibrations they may cause can be best taken care of.

"The thrusting engines are properly secured to the boom. They are of the best type, and have simple reversing mechanism. The swinging engines are reversible and operate the turn-table with ropes instead of chains. There is plenty of room on the car for the necessary locomotive boiler which is constructed along the best possible lines."

*Preservatives for Wood and Metal**

We, the committee on preservatives for wood and metal, beg to submit the following:

As chairman of the committee, I will state that outside of the liberal assistance from Mr. J. F. Parker of the A. T. & S. F. Ry. of San Bernardino, Cal, there have been no contributions I was very much in hopes the committee would take hold of this most important question and give us the benefit of their experience. Personally, my experience has been confined wholly to the treatment of timber. Therefore I am not able to give much of interest as to the outcome of the ma-

*Report of committee of the Association of Railway Superintendents of Bridges and Buildings, read at the fifteenth annual convention held at Pittsburg, October 17 to 19, 1905.

terial after being placed in the structure. I had depended largely on the other members giving me their information; but, as it failed to materialize, I will confine my remarks, which are brief, to the treatment of timber alone.

The subject of wood preservation is one that requires a great deal of discussion and study to be thoroughly understood; even then complexing questions keep arising continually. Conditions vary so in different locations that one form of treatment that is successful in some certain place would be an utter failure in others. There is a too common error of trying to make one standard form of treatment cover all conditions.

It has been carried on in this country upward of thirty years, and quite extensively in the last ten years. The demand for good chemically treated structural timber is increasing as the forest supply decreases and prices advance.

Numerous processes have been tried, some having been successful under certain conditions, others utter failures; some, perhaps, would have been more successful had they been properly applied by some one conversant with the principles of wood preservation, knowing the character and construction of wood. Too many have an idea that to preserve wood a certain routine of work has to be complied with and stop at that,—such as placing a charge in a cylinder, steaming it for a given length of time, running a vacuum up to so many inches for another given length of time, to then apply the preservative fluid and pump into the charge under pressure a given amount. When this is completed the charge is taken out and another one run in and treated in exactly the same manner. No attention is paid to the condition of the material either before or after treatment. The required routine has been fulfilled and that is all that is necessary.

A great many railway concerns and others also submit specifications to contractors to furnish a treated material and outline a routine of treatment to be carried out, never taking into consideration the character and condition of the wood before treatment, but are always careful to wind up the last clause in the specification reading about this way: "Any piles or timbers broken or injured while being treated by careless handling, or checked by overheating, will be rejected and the contractors must substitute new ones therefor or the original cost of such broken or injured piles or timbers will be deducted from the amount due him on the contract."

The specifications are submitted and an inspector placed on a treating plant to see that they are complied with. In fact, the whole work is done under his guidance and instruction and when material comes out ruined the contractor has to stand the loss.

Wood preservation, to be thoroughly successful, must be looked at from a more scientific standpoint in the future than in the past. It must be something more than a mere mechanical operation.

Climatic and soil conditions and characters of the woods for treatment will have to be carefully studied and all the surrounding conditions governing the life of wood in the localities in which it is to be placed taken into consideration in order that a treatment may be applied to suit such conditions.

Of all the different processes used in this country the most universally used is the dead oil of coal tar nettizing process, the latter being used almost exclutar or creosoting process and the zinc chloride or bursively for the preservation of ties. The creosoting process is coming into almost universal use for the treatment of piling and timber for salt water work, as a prevention against marine insects, which are very active, especially in southern countries. It is also being used to a large extent on all pile and timber trestles as a preservative against decay. To a large extent it has been successful, but not as much as it should have been, owing to the fact that lots of the work was done in a careless manner and possibly with a creosote oil that did not contain the proper ingredients for the prevention of decay or the attack of marine insects.

Different ways of applying the creosoting process have been tried, and the one most in use at the present time is that of first steaming the timber with live steam to liquify all resinous matter and evaporate the sap and moisture contained. A vacuum pump is then applied and vacuum being carried for a given length of time, maintaining heat in the cylinder by means of superheated steam circulating through heating pipes distributed throughout the sides and bottom of cylinders; to them apply the creosote oil under pressure. In treating the softer pines, such as Loblolly, shortleafed and long-leafed yellow pine, this process is fairly successful on account of the timber being open grained and easy of access for penetration of heat; also on account of there being a great deal of elasticity in the character of wood, allowing of considerable shrinking during the seasoning process without badly checking or splitting of the timber. With the more firm and closer-grained woods, such as Oregon pine, red fir, etc., especially when the piles and timber are of large dimensions, the steaming and the vacuum process is a complete failure, on account of the heat having to be carried to such an extent in order to reach the center of the timber so it can be thoroughly sterilized. The outcome of this treatment is that the timber is charred to such an extent in order to get it dry, or that there was not enough elasticity in the wood to permit the shrinkage, thereby splitting and checking the wood to such an extent that it is useless for being placed in any structure.

It has been found that these firmer woods can be treated successfully by using a process similar to Boulton's method; that is, of boiling the timber in oil, thus

using the oil as a medium for conveying the heat to the timber, instead of applying it direct as when live steam is used.

The process varies from the Boulton method by eliminating the use of a vacuum pump for drawing off the vapor, as it comes off of its own accord, discharging into a surface condenser, through which cold water is circulating, thus creating its own vacuum. The vapor after becoming condensed is deposited in a hot well, and by having a gauge glass attached close attention can be kept of moisture being extracted from the charge under treatment in order to determine the dryness thereof.

Treating in this manner is applicable to all classes of timber, both close and open grained. It takes no longer than the steaming and vacuum process and there is no liability of affecting the tensil strength of the material as the desired result can be obtained with very low temperature, not running over 220 degrees Fahr., when with the steaming process, to get same result, the temperature would have to be carried to 280 or 300 degrees Fahr., which is detrimental to the wood fiber.

Following is the report from Mr. J. F. Parker, general foreman, B. & B. Dept., Los Angeles Div., A. T. & S. F. Ry. Co.:

As a member of the committee on preservatives for wood and metal, I beg to submit the following, which is the best information I can furnish, and I hope it will help you in making your report to our association:

I have been with the Santa Fe railroad for the past twenty-three years in Southern California, and all the experience I have had with preservatives for wood and metal has been here. Formerly we used redwood where wod came in contact with the ground, but of late years on account of redwood becoming scarce, of poor quality, and of high prices, Oregon pine has taken its place, which is short lived without the application of some preservative.

We have used creosoted piling in both bridge and wharf construction with good results. In Santa Fe wharf at San Diego we have some Oregon pine creosoted piles still in service which were driven in 1887. There the limnoria is very destructive, while the torredo gives us very little trouble. We have tried several methods and expended considerable experimenting on pile protections for wharves without success, and we are now encasing them in a cement mortar jacket 2 and 2½ inches thick from the mud up to high water line. This is expensive, costing $1.10 per lineal foot, but it does the business. We use Gillingham cement, one part, and fine sand, two parts, mixed with salt water. It is handled by divers, using sheet iron casings about three feet long, and when one is filled another is placed above it, building up in this way to the desired height, the mortar being lowered in buckets to the divers.

In about six days the cement is set enough to allow the cases to be taken off. As a preservative for piling and timber in bridges, of course creosoting is the real thing. We have some piles with this treating which have already outlasted two sets of untreated piles. We have also found that salt is an excellent preservative for piles and timber when placed in contact with the ground, by using old material from the wharf at San Diego, which had been soaked in salt water for a number of years. The water in the bay is very salt, as there are no running rivers emptying into it.

Of late years we have extensively used crude oil in bridge repair work, on framed bents and decks, also on wooden spans, with excellent results. The oil being applied heavily with brushes it adds very little to the labor cost, as the oil is cheap and is slapped on by the cheapest men in a gang. It penetrates the wood and prevents rotting and checking.

At one time we used coal tar, but found it was not a success, as it formed an outside coat, closed the pores of the wood and caused dry rot inside.

Our experience here with preservatives for metal has not been very extensive. We commenced the erection of steel bridges here in 1896 and used a paint composed of crude oil and asphaltum heated together. This was not a success and afterwards cost more to remove it than the original work. This composition chills very quickly, and in the early morning and in the latter part of the day the workmen would get it on too thick, and in the middle of the day when the metal and weather was warm they would get it on too thin. We also painted steel tanks with this preparation. In hot weather it becomes soft and runs down to angles and shelves on bridges, gets filled with dust and dirt and forms a substance to hold moisture and rust the steel.

On all our structures where this was we have cleaned it off quite thoroughly and applied "Silica Aluminum Paint" (a locally manufactured paint made from volcanic rock and boiled linseed oil), and common "Brown Mineral" paint with fairly good results.

In 1897 we painted a large oil storage tank with the latter, two coats, using an air spraying nozzle. This tank is at Los Angeles and it is in good condition today.

Three years ago we painted a 38,000-barrel oil storage tank with red lead paint; this is wearing splendidly. We have never used any of the patent paints which are so extensively advertised.

Respectfully submitted,

F. D. BEAL, Chairman.

J. F. PARKER,

Member of Committee.

Railway Signal Association

MEETING of the Railway Signal Association was held at the Grand Union Hotel, New York City, January 9th, 1906, at which time the following papers were presented:

"Signaling on the East Bengal State Railway" by George K. Rogers, Signal Engineer.

"The Care of Storage Battery as Used for Signaling

Devices" by H. W. Lewis, Supervisor of Signals, L. V. R. R.

"Preliminary Report of Installation and Maintenance of Storage Batteries" by I. S. Raymer, Chairman Committee No. 4.

"Line Wire" by Mr. F. F. Fowle, Special Agent, American Telephone & Telegraph Co., New York City.

Chairman Ames, of Comittee No. 12, "Rubber Covered Wire," took up for discussion the feasibility of a system for inspection for rubber covered wires.

In addition to this an amendment of the constitution and one to the By-laws was voted on.

Portable Air-Compressing Plant

WE illustrate herewith a machine which has lately been manufactured by Messrs. Lacy-Hulbert & Co., Limited, of 91 Victoria street, Westminister, at their works at Beddington, for one of the large London gas companies. It consists of a "Boreas" vertical air-compressor, driven by a suitable small gas-engine, the compressed air being delivered into a receiver shown at the back of the plant. Water-tanks are provided for cooling the engine and compressor; the engine is fitted with

PORTABLE AIR COMPRESSING PLANT

magneto ignition, and is carefully governed, the exhaust being efficiently silenced.

A special feature of the machine is the double set of gear arranged to provide a small quantity of air at high pressure, and a relatively larger quantity of air at a low pressure, without alteration to the speed of the engine. No clutch is required for starting the engine, as a relief-cock is provided on the compressor, and the whole plant, self-contained, is mounted on springs and substantial wheels, permitting it to be readily drawn by one man.

We understand that this plant is in constant use for supplying compressed air for caulking the joints of gas-mains and testing the lengths of main when laid. The makers inform us that they make a specialty of portable air-compressing plants worked by gas, petrol, or electric power, and arranged for man or horse traction, and apparently there is a large field of utility for such appliances.

Personals

Frank E. Snyder, first assistant to the chief engineer of the Atchison, Topeka & Santa Fe, died at his home in Chicago on December 23.

Mr. E. D. Fletcher has been appointed chief engineer of the Tacoma Eastern, with office at Tacoma, Wash., succeeding Mr. Henry Shaw.

Mr. W. J. Frein has been appointed architect of the Chicago, Burlington & Quincy, with offices at Chicago, succeeding Mr. W. T. Krautsch, resigned.

Mr. T. J. Tobin has been appointed general material agent of the Western Pacific, in charge of all construction material, with headquarters in the Safe Deposit building, San Francisco, Cal.

Mr. Elisha Lee, assistant division engineer of the Pennsylvania at Buffalo, N. Y., has been transferred to Philadelphia, Pa., as assistant engineer, with supervision over the terminal yards.

Mr. W. H. Willis, heretofore inspector of signals of the Erie, has been appointed signal engineer, with office at Jersey City, N. J., succeeding Mr. C. H. Morrison, assigned to other duties.

Mr. W. S. Painter has been appointed architect of the Canadian Pacific, with office at Montreal, Que. He will have charge of the designing of the company's buildings erected along the system.

Mr. A. P. Greensfelder has resigned as principal assistant engineer of the Terminal Railroad Association of Saint Louis, to become superintendent for the contracting firm of Fruin & Colmon at Saint Louis, Mo.

Mr. C. S. Krick has been appointed principal assistant engineer of the Philadelphia, Baltimore & Washington, with headquarters at Wilmington, Del., succeeding Mr. James Buckelew, promoted; effective on January 1.

Mr. L. J. Leighty has been appointed general foreman of carpenter gangs of the Wabash lines east of Toledo, with offices at Canton, O. He will have general supervision of the construction and repairs of all bridges and buildings.

Mr. H. S. Meily, heretofore supervisor of the Pennsylvania Railroad at Middletown, Pa., has been appointed assistant engineer of the Buffalo and Rochester divisions at Buffalo, N. Y., succeeding Mr. Elisha Lee, transferred.

Mr. L. S. Storrs has resigned as geologist of the Northern Pacific to accept the position of expert and engineer of tests of the New York, New Haven & Hartford, with headquarters at New Haven, Conn.

Mr. Charles B. Teller has resigned as superintendent of track elevation of the Chicago & Western Indiana, with headquarters at Chicago. Mr. Teller was formerly for a number of years connected with the engineering department of the Atchison, Topeka & Santa Fe and the

Denver & Rio Grande, and more recently was general roadmaster of the Choctaw, Oklahoma & Gulf.

Mr. F. A. Matthews, heretofore supervisor of the Kanawha & Michigan at Middleport, O., has been appointed supervisor of the West Virginia division at Hobson, O., succeeding Mr. J. L. Ferguson, resigned. The headquarters of Mr. Ferguson were at Charleston, W. Va. Mr. Charles Ward has been appointed supervisor of the Ohio division of Hobson, O.

Mr. John C. Patterson, heretofore principal assistant engineer of the Great Northern, has been appointed assistant chief engineer, with headquarters at Saint Paul, and the former position has been abolished. Mr. Alexander Stewart, resident engineer at Seattle, Wash., has been appointed assistant chief engineer with office at Seattle. Mr. P. S. Hervin, assistant engineer at Saint Paul, has been appointed resident engineer of the Grand Forks district at Grand Forks, N. D. Mr. C. H. Swigart has been appointed resident engineer of the Seattle district at Seattle, Wash.

Mr. J. W. Barrie, heretofore engineer maintenance of way of the Pennsylvania Lines at Toledo, O., has been transferred to Chicago as engineer maintenance of way of the Chicago Terminal division, to succeed Mr. Nettleton Neff, promoted. Mr. R. C. Harris has been appointed engineer maintenance of way of the Toledo division at Toledo, O.. in place of Mr. Barrie. Mr. Guy Scott has been appointed to succeed Mr. Harris as engineer maintenance of way of the Marietta division at Cambridge, O.

Mr. B. O. Hultgren has been appointed supervisor of the Pennsylvania Railroad at Osceola Mills, Pa., in place of Mr. R. L. Baird, who has been transferred to Middletown, Pa., in a similar capacity, succeeding Mr. H. S. Meily, promoted. Mr. S. H. Kuhn has been appointed assistant supervisor of Division No. 5, vice Mr. B. O. Hultgren. Mr. D. C. Baird has been appointed assistant supervisor of Division No. 17, in place of H. G. Taylor, deceased. Mr. W. G. Shaner has been appointed supervisor at East Brady, Pa. Mr. J. G. Ehrenfeld, supervisor at Emlenton, Pa., has been transferred to South Oil City, Pa.

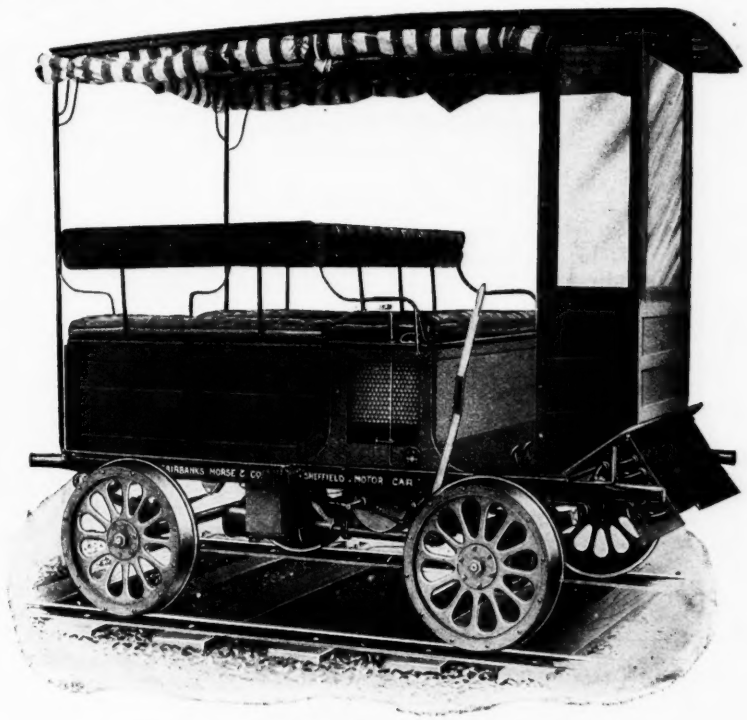
New Gasoline Motor Car

The accompanying cut shows a No. 16 gasoline motor car manufactured by Fairbanks, Morse & Co., Chicago, and is one of several different styles of cars of this class they are at present building.

Early in the summer of this year Mr. George H. Webb, Chief Engineer, Michigan Central R. R. made an inspection trip over the system with one of these cars, and below is some data which is of special interest, showing as it does, what has been actually accomplished with the gasoline motor.

Total distance traveled by the car was 4,347 miles and the total amount of gasoline used was 281 gallons, or an average of 19.7 miles per gallon of gasoline. The records show that on the run from Jackson to Allegan, a distance of 175 miles round trip only 7½ gallons of gasoline were used, or 23.3 miles per gallon. The total cost per mile including lubricating oil, battery cells and everything excepting wages of man in charge was nine-tenths of a cent. Most any railroad man can figure out that this is quite a saving as compared with a steam locomotive pulling a private car.

This gasoline car has its advantages also because of its ability to attain a high rate of speed and maintain it on a long run. From Marshall to Allegan, 66.4 miles distance, was made in one hour and forty minutes, or at the rate of 40 miles per hour, and they report they never stopped the engine once. The distance from Tekonsha to Harris—29 miles—was made in 45 minutes, and the best run of the entire trip was made from



SHEFFIELD INSPECTION MOTOR CAR NO. 16, AUTOMOBILE TYPE

South Haven to Kalamazoo, a distance of 39.6 miles in 45 minutes, or at the rate of 52.94 miles per hour.

The manufacturers report that there is a large demand for cars of this class, now that they have demonstrated that they are a complete success, and their factory with the present facilities is not able to keep up with the orders which are received from all sections of the country.

Railway Association and Club Meetings for February

Canadian Railway Club, Windsor Hotel, Montreal, Que., Feb. 6.

Car Foreman's Club of Chicago, 26 Van Buren street, Chicago, Feb. 13.

Iowa Railway Club, Feb. 20.

New England Railroad Club, Pierce Hall, Copley Square, Boston, Feb. 13.

New York Railroad Club, 154 West 57th street, New York, Feb. 16.

North-West Railway Club, Ryan Hotel, St. Paul, Feb. 13.

Railway Club of Pittsburg, Monongahela House, Pittsburg, Feb. 23.

St. Louis Railway Club, Southern Hotel, St. Louis, Feb. 9.

Richmond Railroad Club, Richmond, Va., Feb. 8.

Pacific Coast Railway Club, San Francisco, Cal., Feb. 17.

Western Railway Club, Auditorium Hotel, Chicago, Feb. 19.

The next meeting of the American Railway Engineering and Maintenance of Way Association will be held at the Auditorium Hotel, Chicago, March 20, 21, and 22.

The Merchant & Evans Co., successor to Merchant & Co., Philadelphia, Pa., have issued a catalogue on Roofing Rules. This is a hand book on sheet metals in building construction for engineers, architects and builders. It also has a reprint of a fire test of slag vs. tin roofing exhibition at Baltimore. This test proved that the metal roof is a safer medium against fire than roofing containing tar, pitch or asphalt.

The General Ry. Supply Co., St. Louis, has recently been organized. They handle railway, mill and contractors supplies. Mr. W. H. Davis, general manager of the firm, was formerly associated with the Frisco System, Terminal R. R. Assn. of St. Louis, and Mexican Central R. R. in their purchasing departments. His wide acquaintance and experience in this field will be of advantage in the railway supply business. They report a very satisfactory business.

The Hall Signal known as the electric semaphone normal clear system, operated by storage batteries, is to be put in on the Erie road at a cost of $225,000. The line is to be equipped by districts of which the first will be between Middletown, N. Y., and Bergen, N. J., which points are 68 miles apart. The location of these signals is to be variable, some being placed about 3,500 feet apart, and others about 5,450 feet apart, which arrangement is understood to be followed over the entire line as the equipment is installed. This system is to supercede the manual block which has been in force on the Erie for many years.

Among railway supply firms, that of Hay & Hayward of St. Louis, Mo., has recently been organized. Both members of the firm have a large acquaintance among railway officials, Mr. Hayward having been until recently secretary and treasurer of the Commonwealth Steel Company, and Mr. Hay having been identified with the railway supply business for several years. Previous to this he was connected with the manufacture of rails and heavy railway material by the largest steel companies. Their acquaintance and experience in this field places them in a position of advantage which few firms enjoy.

Consul Dill, of Port Hope, Ontario, reports that the Grand Trunk railway will make that place a railway center, and that with this end in view arrangements are being made to establish a ferry between Port Hope and Rochester, N. Y. The consul writes: It is now certain that the Grand Trunk Railway will make an important railway center at this place. A company has been formed to operate a car ferry on Lake Ontario between Port Hope and Charlotte, Port of Rochester, N. Y. The company is capitalized at half a million dollars. One boat will be put on at first which will carry 25 freight cars and will make one round trip per day, summer and winter. They hope to begin running by July 1, 1906. It is rumored that when the road has been put in first-class condition and the ferry running, cattle, grain, and other merchandise will be diverted from their ordinary routes and sent to the ports of New York and Boston. The distance this way would be much less to the ocean liners than to Portland, St. John, or Halifax. With the building of the Grand Trunk Pacific this ferry service will be the connecting link between Boston, New York, Philadelphia, and Baltimore and the Pacific coast over a new line.

Consul Keene, of Geneva, reports that the opening of the Simplon Tunnel, which was fixed for April 1, has been postponed to May, by action of the Swiss authorities. The consul says: The official opening of the new international line through the Simplon Tunnel, after having been advertised for April 1, 1906, is now reported as being postponed until May 1. After having been for a considerable time under discussion, the mode of traction between Brigue and Domo d'Ossola—i. e., on 40 kilometers (about 25 miles)—is reported to be electrical in accordance with a decision recently made by the federal Department of Swiss railroads. The Swiss system of traction now in use on the railroad Berthoud-Thoune, in the Canton of Berne, will be applied with up-to-date improvements on the Simplon line. The first two electrical engines, when delivered at the end of the year, will first be tried on the Italian electrical lines of the Valteline. Electrical traction on Swiss railroads is a new thing; but it seems only natural that Switzerland, so rich in "white coal," begins to utilize its wealth of water, and supersedes, by the power derived from it, the enormous quantity of coal imported from Germany, France, Belgium, and England. This new trial of electrical power on such an important new line will be watched with keen interest. If successful, the new mode of traction will certainly be employed all over the country, and there may be openings for our manufacturers at home in that line.

The opening of the first section of the Shanghai-Nanking Railway, on November 18, 1905, was the occasion of a pleasant commingling of foreigners and Chinamen. The chief address was delivered by Lord Li, the adopted son of the late Li Hung Chang, forwarded by Consul-General Rodgers from Shangai. Lord Li proved an excellent orator, his remarks being applauded by the Englishmen's "hear," "hear." Lord Li stated that Shanghai is the best situated seaport in the continent of Asia. Ships coming from the Pacific, Atlantic, and Indian oceans all take Shanghai as the principal rendezvous, its advantages and volume of trade being compared with London and New York. Hence the importance of the Shanghai-Nanking Railway in connecting the interior with the great shipping port. The speech traced the early difficulties of railroad promotion in China, the first undertaking being a line by some foreigners from Shanghai to Woosung, which the Government subsequently bought over and consigned into disuse. There was then a lull until Marquis Li Hung Chang opened the Kaiping mines, starting a railroad thereto

from Tangshan, the first ever built by China herself. Then followed such lines as the Tientsin-Shanhaikuan Railway, the Peking-Tientsin Railway and the Peking-Hankow Railway, mostly built from foreign loans. This was not necessarily because of the poverty of China, but because the home people were conservative.

New South Wales has just celebrated the fiftieth anniversary of the introduction of railways into that country. The amount invested in railroads is said to be $209,564,000, annual earnings $17,928,264, working expenses $10,668,083, balance, after paying working expenses representing 3½ per cent on capital, $7,260,180. Length of track in operation, 3,280 miles; total number of passengers carried for the year ended June, 1905, 35,158,150, over 188,667,952 miles. For a long time the locomotives were imported, largely from the United States. The Government has arranged to buy from home (New South Wales) manufacturers "P" and "T" patterns for $349 a ton It has also arranged to buy steels rails from New South Wales manufacturers. The result is an increase in price for the local over the imported article of 8.8 per cent. This on the last five years' purchases would nave made a difference of $223,105 or 11.5 per cent. As an offset, attention is called to the fact that local fish plates show 80,000 to 90,000 pound per square inch pressure, while the strength of the imported was only 60,000 to 68,000 pounds. This reduces the losses on the local product from $11.5 to $6.7. At best, a loss of $129,746 is figured out on the basis of a five-years' purchase equal to that of the last five years. Still there is something to be said in favor of the fact that these $129,746, plus the $20,000,000 upon which they are based, are spent in New South Wales; in other words, encouragement is given to home industries.

Consul-General Guenther, of Berlin, writes as follows: The Berlin paper, Mittag, says that bricks of sand and lime, which were first made in 1880, but have only been used on a large scale for the last eight years, are becoming a dangerous rival to the old style of clay bricks. These new bricks consist solely of sand and lime without any other binding material or ingredient, and they cost much less than clay bricks. Furthermore sand is found almost everywhere and factories can be placed at points where transportation is favorable, while the clay used for clay bricks is often found in locations whence the transportation is very expensive. The assertion that the quality is superior to clay bricks remains to be proved. The industry is too young for a final opinion as to how long or well these new bricks will last. They possess a very great resistance to pressure and can in many instances be substituted for clinkers. The edges, if the proper pressure is employed in their manufacture, are sharp and even; they do not warp, and the walls erected from them present an even and uniform apearance. The addition to the criminal court-house at Berlin-Moabit, the Queen Louise Church at Konigsberg, a large part of the new Berlin city hall, numerous buildings of the war department at Berlin, and many structures in the Prussian provinces, were built of these lime-sand bricks. Time alone will tell whether they are as durable and weatherproof as the old style of clay bricks.

Consul Caldwell, of San Jose, writes as follows in regard to railway construction in Costa Rica: The report of the engineers appointed to survey a route for the completion of the Pacific Railway has been presented to the Government. The report recommends the extension of the line from its present terminus at Santo Domingo de San Mateo to Esparta, to connect with the road from that point to Puntarenas. The distance to be covered is, according to the plans presented, 21 miles. It is proposed to relocate 4 miles of the line between Esparta and Puntarenas, straightening curves and reducing grades. This makes a total of 25 miles. The estimated cost is $32,550 per mile, or a total cost of $813,750. In addition, it is proposed to construct a branch from a point on the line already built to Alajuela, a town 13½ miles west of San Jose and terminus of the railroad to the Atlantic coast, thus giving that town more direct connection with the Pacific. The length of the proposed branch is 4 miles and the estimated cost $60,450. This sum added to the above estimate brings the total up to $874,200. The permanent commission of the Congress of Costa Rica, authorized to pass laws in the intervals of sessions of Congress subject to the approval of that body at its next session, by decree of November 22 has authorized the executive power, whenever deemed expedient, to proceed with the construction of the lines above referred to, and for that purpose to make use of the national credit for an internal loan not exceeding $930,000, at a rate of interest not exceeding 8 per cent per annum.

Daily Consular and Trade Reports in previous issues reported the activity in South American railroad building. Many new short lines are projected, some of which are as follows: The Argentine Government has decided, says the French Bulletin of Buenos Ayres, on the construction of railway lines between the following points: Villa Mercedes and Rosario, Cordoba and Rio Cuarto, Holmberg and Dolores, Dean Funes and Rosario, with a branch line to Villa Maria, Barranquera, and Tintina, via Otumpa, Formosa, and Embarcacon, Soto and Dolores, San Juan and Jachal. These lines will form part of the State railway system. The Argentine Congress has sanctioned the following concessions: To Senor Santiago, J. Duhalde for a railway from Rufino (Santa Fe Province) to Catrilo (Pampa Central), and to Senores Taglioni for a railway from Mar del Plata to Azul via Tandil. The German consul at Valparaiso reports the following concessions for railways in Chile: Mauro Lacalle, Valparaiso, for the construction of a railway between the saltpeter works, Pepita, and Castilla. Edwardo Caballero and the Progreso Saltpeter Company, Antofagasta, for a line from kilometer 133 of the Antofogasta-Bolivia Railway to Ansonia Saltpeter Works. The Compania Commercial y Ganadera Chile-Argentina, Valparaiso, for a suspension railway, 6 kilometers long, from Casa Pangne to the Argentine frontier. The Valparaiso Saltpeter Company, for a line 7 kilometers long, from the Aguas-Blancas-Caleta-Coloso Railway to La Valparaiso Saltpeter Works. The Leonor Saltpeter Company, Santiago, to their works from the Antofagasta-Bolivia Railway. The British charge at Buenos Aires reports that an Argentine syndicate has just obtained a concession from Bolivia to construct a railway of 1-meter guage from Santa Cruz eastward to Pedro Suarez, where a port is to be made on the Bolivian side of the river Paraguay, opposite Corumba, Brazil. The line would be 620 kilometers (385 miles) long, entirely in Bolivian territory. The Bolivian and the Argentine governments are negotiating for a connection in Bolivia, from Potosi, with the Argentine Central Northern Railway, a Government line which is being constructed northward from Jujay to the Bolivian frontier. This will offset to some extent the new line from Arica to La Paz (the construction decree for which was published in Consular and Trade Reports for October 31), which will give Bolivia a direct outlet westward to the Pacific coast. When the Panama Canal is completed, the Arica-La Paz Railway will be in a still stronger position to compete with trade routes via the river Plate and South Atlantic. The British charge at Montevideo reports that an arrangement has been concluded between the Uruguayan Central Railway and the Government for the extension to Centurion, a place on the river Yaguaron, forming the boundary of Uruguay and Brazil, of the railway now terminating at Nico Perez, Province of Minas. The arrangement also includes a branch line to Treinta y Tres. The length of the lines will be from 250 to 300 miles, to be completed in three years at an expenditure of $7,500,000 gold. The Paraguayan Government intends constructing a meter guage railway from a point on the river Paraguay near San Pedro, through rich forest lands and through the yerba-mate district, with the idea ultimately of terminating at the frontier of the Brazilian State of Matto Grosso.

Technical Publications

Manual of Recommended Practice for Railway Engineering and Maintenance of Way. Edition of 1905. Published under direction of the Committee on Publications by the American Railway Engineering and Maintenance of Way Association. This has 175 pages, is neatly bound in cloth and has for its contents the Definitions, Specifications and Principles of Practice adopted and Recommended by the American Railway Engineering and Maintenance of Way Association.

RALPH WILDER IN THE CHICAGO RECORD-HERALD

BIOGRAPHICAL DIRECTORY OF THE RAILWAY OFFICIALS OF AMERICA. Edition of 1906. Cloth, 694 pages, 6 by 8½ inches. Price, $3. Railway Age Company, Chicago.

Twenty years ago The Railway Age Company undertook the publication of a directory of railway officials, the most important feature of which should be a concise history of the railway positions held by each individual named. The value of such a record in permanent form, of appointments, promotions and changes, giving simply dates, titles and names of roads, was proved by the demand for the first volume, issued in 1885, and has justified the steadily increasing cost and size of successive editions. The Biographical Directory is recognized as an indispensable reference book in every railway library, because it is the only history of American railway official life published, and the six closely printed volumes that have now been issued are found to constitute a record of changes in railway personnel, impressive in number and notable in character and result. The edition for 1906 just from the press is the most complete and comprehensive that has yet been issued, as might be expected from the great growth of American railways.

The first issue, in 1885, contained 3,764 names, requiring 276 pages. The present volume gives 5,000 personal histories, occupying 694 pages. Each successive volume has shown many new officials added and many old names removed by death or retirement from railway life, and the records for 1906 will be found to be largely those of men not named in the volume for 1885. In twenty years a new generation has come into command of our railways. Comparing the present issue with the preceding volume for 1901, the number of sketches eliminated is 1,280, of which 275 are omitted on account of death and 1,005 on account of retirement from service, etc.

Of the more than 1,200 new sketches in this volume, many are those of young men who have come to official rank since the last Directory was published and there also appear a number of railway officials of extended service who had hitherto failed to furnish the necessary data.

Included in this volume are the names of many men who have left important positions in railway service to engage in other business, but whose railway record still continues a matter of general interest. The policy has been continued of republishing the sketches of former railway officials, now retired, where there is evidence that they are living. While the rule has been followed to print no name to which some record of official life could not be appended, it will be found that the number of general, divisional and departmental officers of American railways who do not appear in these biographies is small, and the omissions are not the result of any lack of continuous effort by the publishers during the last six months, by means of letters and blank forms of inquiry.

Of the 5,000 histories in the new volume, 634 or 12.92 per cent. are those of officials in the executive departments—presidents, vice-presidents, secretaries and treasurers; 944, or 19.25 per cent. represent the operating departments—general managers, general and assistant general superintendents, division superintendents, superintendents of car service and superintendents of telegraph; 298, or 6.8 per cent. cover accounting officers; 613, or 12.50 per cent traffic officials, none below the rank of assistant general freight or assistant general passenger agent; 270 or 5.50 per cent. are officers of the mechanical departments, master mechanic or higher; 440, or 9.05 per cent, represent the engineering department; 123, or 2.50 per cent. the legal department, and 548, or 11.17 per cent. perpetuate the history of former railway officials still living, of whom retired from service there are named 365, left the service to engage in manufacturing, supply or construction business allied to railways, 56, and former officials now engaged in other lines of business, 127. There are 1,030 sketches covering officials not in the above classifications, and minor officials in the various departments, including purchasing agents, division freight and passenger agents, commercial agents, general agents and some passenger agents at important points. There are also a few assistant superintendents, trainmasters and roadmasters with official powers. Finally, in recognition of the increasing voice of government in the management of our railways, there are added sketches of the personal history of 96 national and state railway commissioners, some of whom it will be found have had experience in the railway service.